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ENHANCED CELLULAR PRESERVATION BY CLAY MINERALS IN 1 BILLION-YEAR-OLD LAKES

SUPPLEMENTARY INFORMATION

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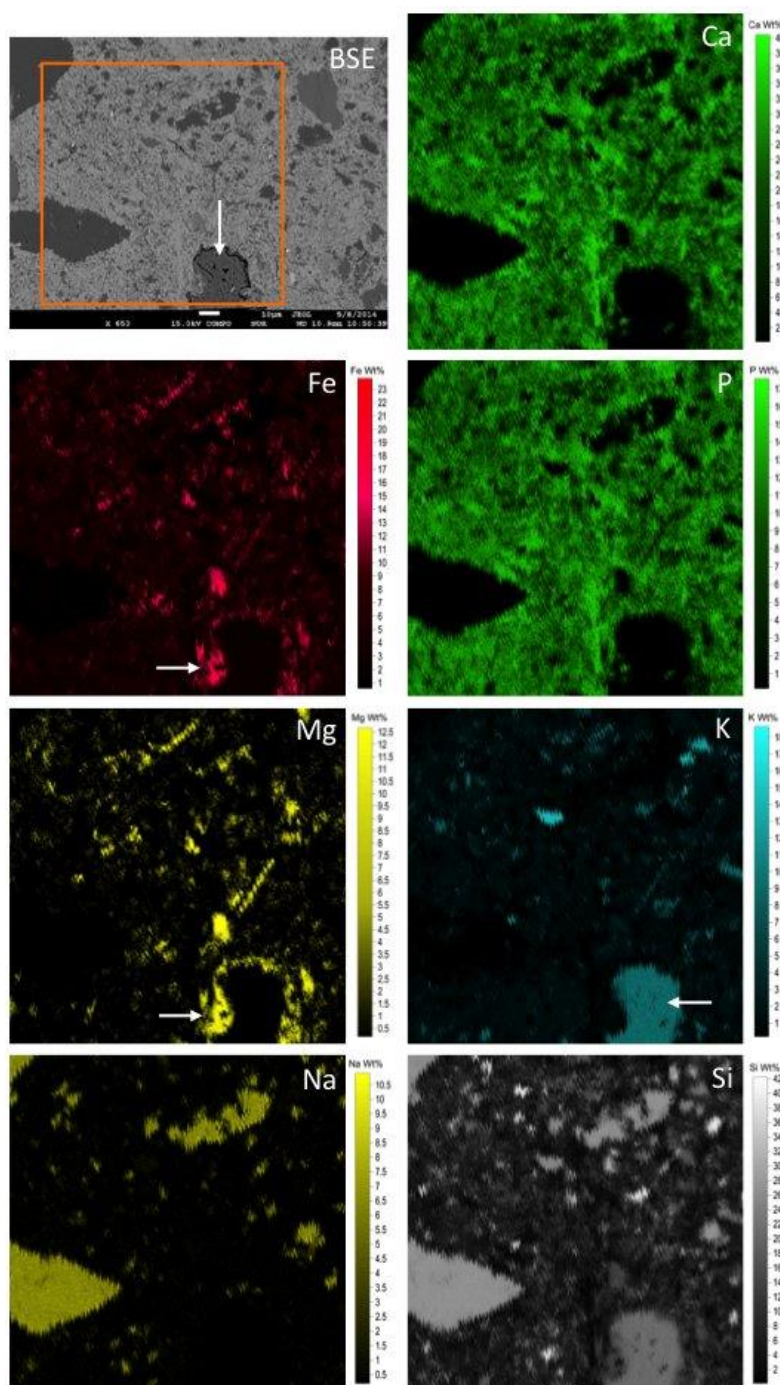


Figure S1. Mineral distribution around the microfossil shown in Figure 2 of the main article. The microfossil in question is arrowed in the BSE image, and the area element-mapped using a microprobe is denoted by the orange box. Note Fe and Mg enrichment correlating with the microfossil walls (arrows in Fe and Mg images), plus K enrichment in the microfossil interior (arrow in K image). Scale bar on BSE image is 10 μm . The remainder of the field of view comprises calcium phosphate with some detrital sediment entrained within it (e.g., Na-feldspar, K-feldspar, quartz and minor biotite flakes).

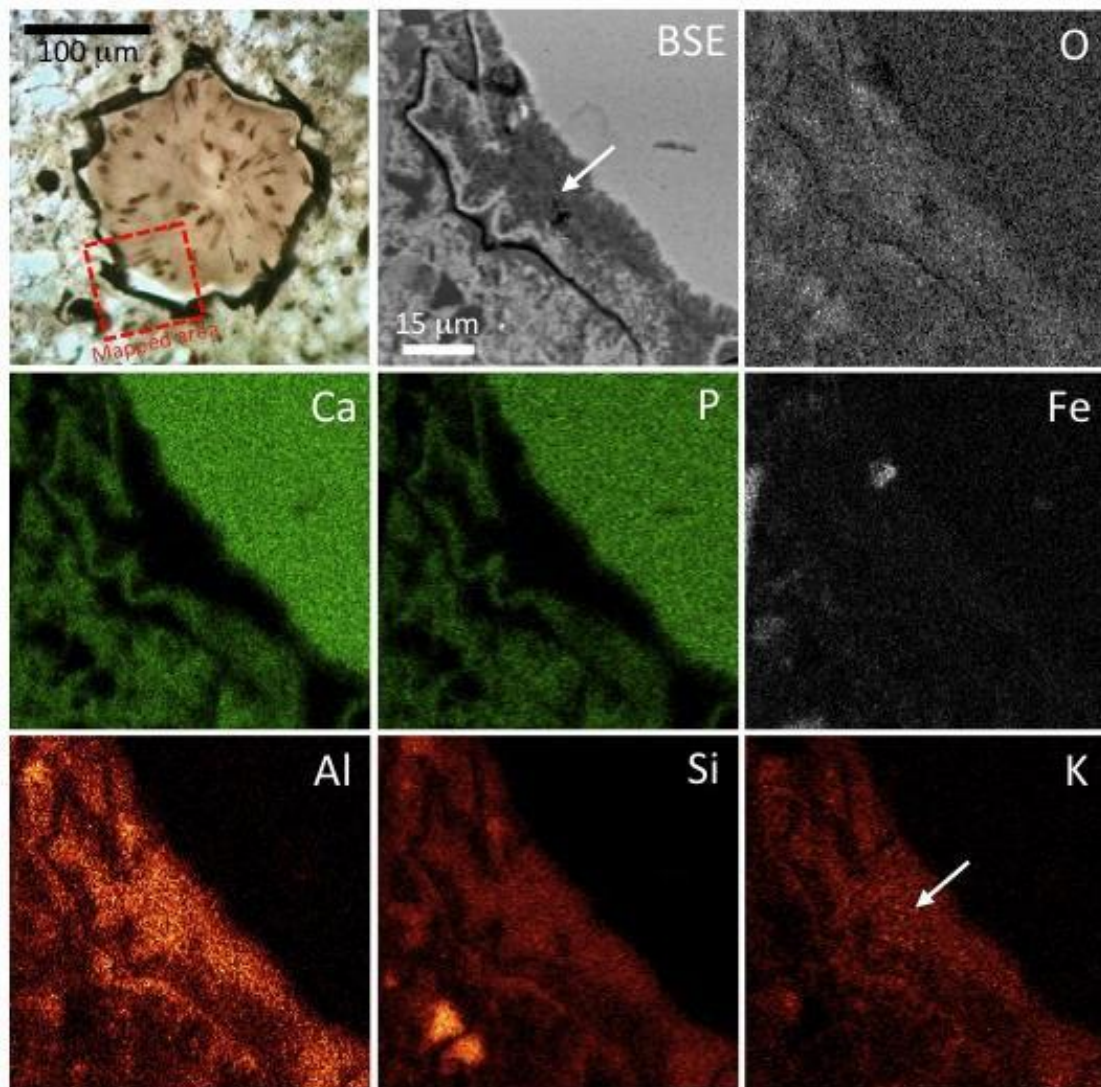


Figure S2. Clay mineral and phosphate distribution in a large eukaryote microfossil whose walls appear to have been folded and fractured prior to fossilization. Most of the microfossil interior is filled with calcium phosphate, but K-rich clay minerals occur close to the wall (region arrowed in BSE and K map). Immediately outside the wall is a mixture of calcium phosphate, plus Fe-rich and K-rich clays. Scale in BSE image also applies to all elemental maps.

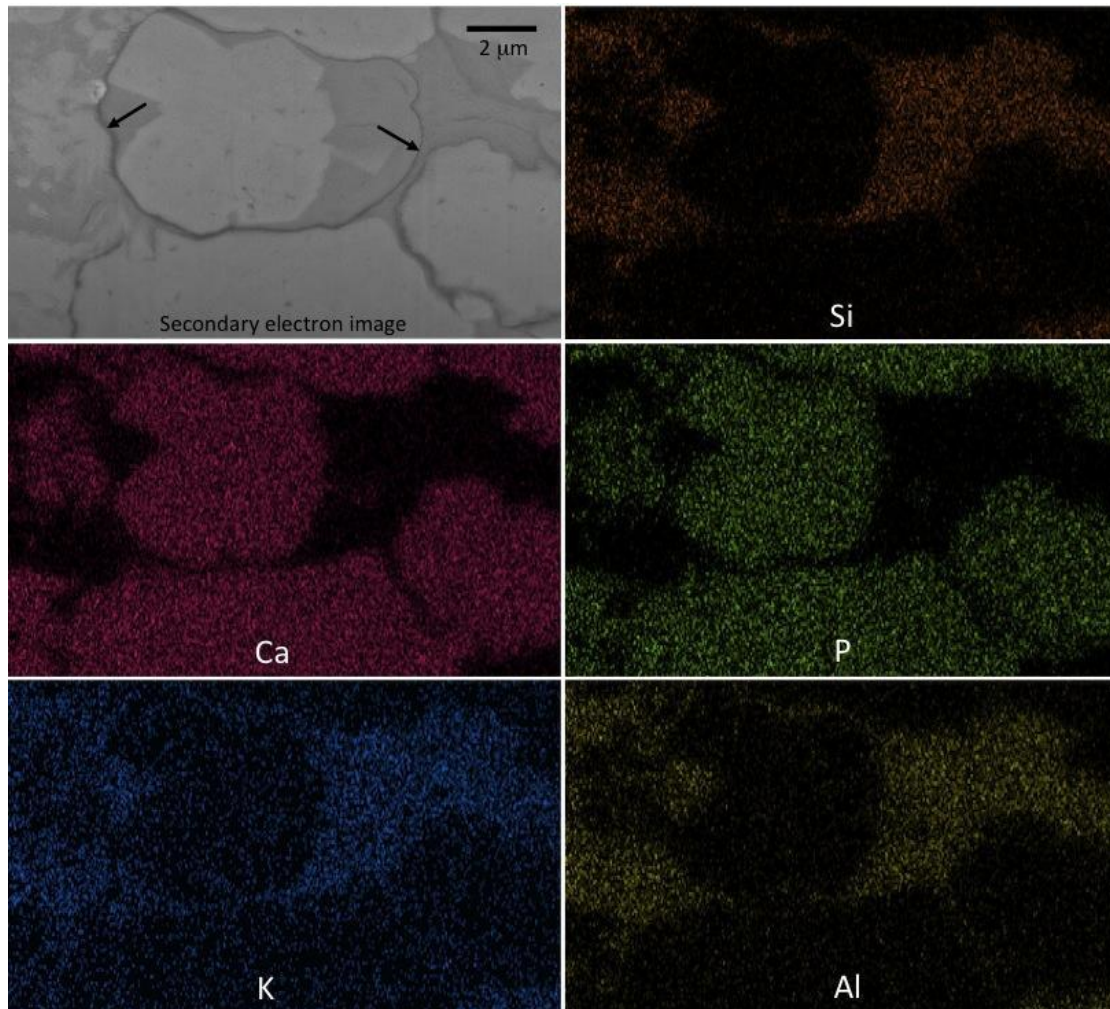


Figure S3. Clay mineral and phosphate distribution in a cluster of prokaryote cells with adpressed walls, from the Cailleach Head Formation. The secondary electron image (top left) shows cell walls (dark grey, examples arrowed), plus two fossilizing mineral phases. The SEM-EDS elemental maps show that the pale grey micro-crystalline phase is calcium phosphate, and the medium grey amorphous to nano-crystalline phase is a K-rich clay mineral. Both the clay mineral and phosphate are found within and surrounding individual cells and do not show strong patterns of zonation. Scale bar on the secondary electron image also applies to all the element maps.



Figure S4. Bright-field TEM images of the nano-structure of clay minerals in the vicinity of eukaryote cellular material. **a)** K-rich and Fe-rich clay mineral sheets aligned parallel to the wall of a large inferred eukaryote microfossil from the Diabaig Formation, resulting in excellent fidelity of cell wall preservation (from the same specimen as Fig. 5). Note, sharp transition from Fe-rich to K-rich phase across the cell wall boundary. Also note the single clay nano-crystal that appears to penetrate the cell wall (arrow). **b)** K-rich clay mineral sheets aligned parallel (e.g. arrow) to the multiple wall layers in a eukaryote vesicle, again resulting in excellent fidelity of preservation of the organic material (from the same specimen as Fig. 3). **c)** Fe-rich clay mineral sheets aligned approximately perpendicular to a eukaryote cell wall (same specimen as ‘a’), leading to poorer fidelity of preservation of the organic material (most noticeable in circled area). **d)** Fe-rich clay mineral that has grown perpendicular to a cell wall (arrow) and appears to have disrupted and split the cell wall during growth (same specimen as ‘a’). Exterior of microfossil is ‘down’ in all panels.